

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

WIPD
REC'D 08 JUN 2005

PCT WIPO PCT

To:
OYEN WIGGS GREEN & MUTALA LLP
The Station
480 - 601 West Cordova Street
VANCOUVER, British Columbia
Canada, V6B 1G1

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing 02 June 2005 (02-06-2005)
(day/month/year)

Applicant's or agent's file reference
U008 0624

FOR FURTHER ACTION
See paragraph 2 below

International application No.

PCT/CA2005/000124

International filing date (day/month/year)
02 February 2005 (02-02-2005)

Priority date (day/month/year)
02 February 2004 (02-02-2004)

International Patent Classification (IPC) or both national classification and IPC
B01D 57/02 G01N 1/28 G01N 1/40 G01N 37/00 G01N 27/447

Applicant
THE UNIVERSITY OF BRITISH COLUMBIA ET AL

1. This opinion contains indications relating to the following items :

- | | |
|--|--|
| <input checked="" type="checkbox"/> Box No. I | Basis of the opinion |
| <input type="checkbox"/> Box No. II | Priority |
| <input checked="" type="checkbox"/> Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| <input checked="" type="checkbox"/> Box No. IV | Lack of unity of invention |
| <input checked="" type="checkbox"/> Box No. V | Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| <input type="checkbox"/> Box No. VI | Certain documents cited |
| <input checked="" type="checkbox"/> Box No. VII | Certain defects in the international application |
| <input checked="" type="checkbox"/> Box No. VIII | Certain observations on the international application |

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/CA
Canadian Intellectual Property Office
Place du Portage I, C114 - 1st Floor, Box PCT
50 Victoria Street
Gatineau, Quebec K1A 0C9
Facsimile No.: 001(819)953-2476

Date of completion of this opinion
May 24, 2005

Authorized officer

James McCarthy (819) 994-0411

Box No. I **Basis of this opinion**

1. With regard to the language, this opinion has been established on the basis of:

 ☒ the international application in the language in which it was filed

 ☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of :
 - a. type of material
 ☐ a sequence listing
 ☐ table(s) related to the sequence listing
 - b. format of material
 ☐ on paper
 ☐ in electronic form
 - c. time of filing/furnishing
 ☐ contained in the international application as filed.
 ☐ filed together with the international application in electronic form
 ☐ furnished subsequently to this Authority for the purposes of search.
- 3 ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statement that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments :

Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non obvious), or to be industrially applicable have not been examined in respect of :

- ☐ the entire international application
- ☒ claim Nos. **183 and 184**

because:

- ☐ the said international application, or the said claim relate to the following subject matter which does not require an international search (*specify*) :

- ☒ the description, claims or drawings (*indicate particular elements below*) or said claim are so unclear that no meaningful opinion could be formed (*specify*) :

Omnibus claims, such as Claims 183 and 184, are of indefinite scope thus prohibiting the examiner from forming a meaningful opinion with regard to novelty, inventive step and industrial applicability.

- ☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed (*specify*):

- ☐ no international search report has been established for said claims Nos.

- ☐ a meaningful opinion could not be formed without the sequence listing; the applicant did not, within the prescribed time limit:

- ☐ furnish a sequence listing on paper complying with the standard provided for in Annex C of the Instructions, and such listing was not available to the International Searching Authority in a form and manner acceptable to it.

- ☐ furnish a sequence listing in electronic form complying with the standard provided for in Annex C of the Instructions, and such listing was not available to the International Searching Authority in a form and manner acceptable to it.

- ☐ pay the required late furnishing fee for the furnishing of a sequence listing in response to an invitation under Rule 13ter.1(a) or (b).

- ☐ a meaningful opinion could not be formed without the tables related to the sequence listings; the applicant did not, prescribed time limit, furnish such tables in electronic form complying with the technical requirements provided for in Annex C-bis of the Administrative Instructions, and such tables were not available to the International Searching

- ☐ the tables related to the nucleotide and/or amino acid sequence listing, if in electronic form only, do not comply technical requirements provided for in Annex C-bis of the Administrative Instructions.

- ☐ See Supplemental Box for further details.

Box No. IV Lack of unity of invention

1. ☒ In response to the invitation (Form PCT/ISA/206) to pay additional fees the applicant has, within the applicable time
- ☐ paid additional fees
 - ☐ paid additional fees under protest and, where applicable, the protest fee
 - ☐ paid additional fees under protest but the applicable protest fee was not paid
 - ☒ not paid additional fees

2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is
- ☐ complied with
 - ☒ not complied with for the following reasons :

The claims are directed to a plurality of inventive concepts as follows:

Group A: Claims 1-112, 141-167 and 182 are directed to a method and apparatus for causing motion (or concentration) of particles in a medium comprising a time-varying driving field and a mobility-varying field (being different in type from the former and/or non-aligned with the former) wherein said fields are applied simultaneously to the medium.

Group B: Claims 113-140 are directed to methods for extracting particles from a first medium comprising the steps of providing a second medium adjoining the first medium at an interface and applying an asymmetric driving field across the interface which causes the particles to drift across the interface into the second medium.

Group C: Claims 168-181 are directed to an apparatus for concentrating particles from a medium comprising three or more non-collinear electrodes in electrical contact with the medium and a control system connected to vary voltages applied to said electrodes over time to apply to the medium a first electric field having an alternating component directed in a first direction and a second electric field having an alternating component transverse to the first direction.

The claims must be limited to one inventive concept as set out in *PCT Rule 13*.

4. Consequently, this opinion has been established in respect of the following parts of the international application :
- ☐ all parts
 - ☒ the parts relating to claim **1-112, 141-167 and 182 (Group A)**

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims 1-112, 141-167 and 182	YES
	Claims	NO
Inventive step (IS)	Claims 1-112, 141-167 and 182	YES
	Claims	NO
Industrial applicability (IA)	Claims 1-112, 141-167 and 182	YES
	Claims	NO

2. Citations and explanations :

Reference is made to the following document:

D1: Asbury et al., "Trapping of DNA In Nonuniform Oscillating Electric Fields", Biophysical Journal, Volume 74, February 1998, 1024-1030.

D1 appears to represent the closest prior art and describes a method in which DNA molecules are pulled by a gradient force to regions of high electric field strength due to the induction of an electric dipole. Molecules can then be locally trapped in an oscillating field using strips of very thin gold film to generate strong electric fields with steep gradients. D1 does not describe the simultaneous use of a time-varying driving field and a mobility-varying field to induce particle motion.

The subject matter of Claims 1-112, 141-167 and 182 meets the requirements of *PCT Article 33(2)*. The subject matter of Claims 1-112, 141-167 and 182 is novel in respect of the prior art as defined in the regulations (*PCT Rule 64*) and thus meets the requirements of *PCT Article 33(2)*.

The subject matter of Claims 1-112, 141-167 and 182, involves an inventive step in respect of the prior art as defined in the regulations (*PCT Rule 65(1)(2)*) and thus meets the requirements of *PCT Article 33(3)*.

The subject matter of Claims 1-112, 141-167 and 182 comply with *PCT Article 33(4)* since the claimed invention is considered to be industrially applicable since according to its nature, it can be made or used (in the technological sense) in industry.

Box No. VII **Certain defects in the international application**

The following defects in the form or contents of the international application have been noted :

The description does not comply with *PCT Rule 11.13(m)*. The same features, when denoted by reference signs, shall, throughout the entire application, be denoted by the same signs. On page 50 (paragraph 0150) of the description, reference character "25" is used to represent the "capillary", however previously, reference character "125" was used to represent the "capillary".

The drawings do not comply with *PCT Rule 11.13(f)*. Reference signs not mentioned in the description must not appear in the drawings, and vice versa. Reference signs "21A" and "21B" (page 27, lines 14 and 15, respectively) do not appear in the drawings. Also, reference sign "25" (page 50, line 4) does not appear in the drawings.

All documents referred to in the description of an application should be available to the public. Reference to the documents on page 1, lines 7 and 8 should be deleted or replaced by their corresponding patent or publication numbers (*PCT Article 5*).

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made :

Claims 183 and 184 fail to comply with *PCT Rule 6.4(b)*. Omnibus claims are of indefinite scope thus compromising the overall clarity of the claims.

The dependent claims fail to comply with *PCT Rule 6.4(b)*. Dependent claims shall be construed as including all the limitations contained in the claim(s) to which they refer. In this instance, the inclusion of the subject-matter of Claim 11 into subsequent dependent claims is problematic. For example, Claim 33 refers to Claim 25 which refers to Claim 11 which stipulates that the driving field and the mobility-varying field are "of the same type". However, Claims 25 and 33 define an *acoustic* driving field and a mobility-varying field comprising exposing the particles to *electromagnetic radiation*, respectively. Note that this problem has been identified throughout the set of dependent claims which include a reference to Claim 11.

Claim 67 is indefinite and does not comply with *PCT Article 6*. The expression "the photoactive molecules" (Claim 67, line 1) has no antecedent.

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

105-99307
WIPO

REC'D 08 JUN 2005

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To:
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480 - 601 West Cordova Street
VANCOUVER, British Columbia
Canada, V6B 1G1

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INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing (day/month/year) 02 June 2005 (02-06-2005)

Applicant's or agent's file reference
U008 0624

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/CA2005/000124

International filing date (day/month/year)
02 February 2005 (02-02-2005)

Priority date (day/month/year)
02 February 2004 (02-02-2004)

International Patent Classification (IPC) or both national classification and IPC
B01D 57/02 G01N 1/28 G01N 1/40 G01N 37/00 G01N 27/447

Applicant
THE UNIVERSITY OF BRITISH COLUMBIA ET AL

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2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

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Place du Portage I, C114 - 1st Floor, Box PCT
50 Victoria Street
Gatineau, Quebec K1A 0C9
Facsimile No.: 001(819)953-2476

Date of completion of this opinion
May 24, 2005

Authorized officer
James McCarthy (819) 994-0411

Box No. I **Basis of this opinion**

1. With regard to the language, this opinion has been established on the basis of:

 ☒ the international application in the language in which it was filed

 ☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of :
 - a. type of material
 ☐ a sequence listing
 ☐ table(s) related to the sequence listing
 - b. format of material
 ☐ on paper
 ☐ in electronic form
 - c. time of filing/furnishing
 ☐ contained in the international application as filed.
 ☐ filed together with the international application in electronic form
 ☐ furnished subsequently to this Authority for the purposes of search.
- 3 ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statement that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments :

Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non obvious), or to be industrially applicable have not been examined in respect of :

- ☐ the entire international application
- ☒ claim Nos. **183 and 184**

because:

- ☐ the said international application, or the said claim relate to the following subject matter which does not require an international search (*specify*) :

- ☒ the description, claims or drawings (*indicate particular elements below*) or said claim are so unclear that no meaningful opinion could be formed (*specify*) :

Omnibus claims, such as Claims 183 and 184, are of indefinite scope thus prohibiting the examiner from forming a meaningful opinion with regard to novelty, inventive step and industrial applicability.

- ☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed (*specify*):

- ☐ no international search report has been established for said claims Nos.

- ☐ a meaningful opinion could not be formed without the sequence listing; the applicant did not, within the prescribed time limit:

- ☐ furnish a sequence listing on paper complying with the standard provided for in Annex C of the Instructions, and such listing was not available to the International Searching Authority in a form and manner acceptable to it.

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- ☐ pay the required late furnishing fee for the furnishing of a sequence listing in response to an invitation under Rule 13ter.1(a) or (b).

- ☐ a meaningful opinion could not be formed without the tables related to the sequence listings; the applicant did not, prescribed time limit, furnish such tables in electronic form complying with the technical requirements provided for in Annex C-bis of the Administrative Instructions, and such tables were not available to the International Searching

- ☐ the tables related to the nucleotide and/or amino acid sequence listing, if in electronic form only, do not comply technical requirements provided for in Annex C-bis of the Administrative Instructions.

- ☐ See Supplemental Box for further details.

Box No. IV Lack of unity of invention

1. ☒ In response to the invitation (Form PCT/ISA/206) to pay additional fees the applicant has, within the applicable time
☐ paid additional fees
☐ paid additional fees under protest and, where applicable, the protest fee
☐ paid additional fees under protest but the applicable protest fee was not paid
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2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is
☐ complied with
☒ not complied with for the following reasons :

The claims are directed to a plurality of inventive concepts as follows:

Group A: Claims 1-112, 141-167 and 182 are directed to a method and apparatus for causing motion (or concentration) of particles in a medium comprising a time-varying driving field and a mobility-varying field (being different in type from the former and/or non-aligned with the former) wherein said fields are applied simultaneously to the medium.

Group B: Claims 113-140 are directed to methods for extracting particles from a first medium comprising the steps of providing a second medium adjoining the first medium at an interface and applying an asymmetric driving field across the interface which causes the particles to drift across the interface into the second medium.

Group C: Claims 168-181 are directed to an apparatus for concentrating particles from a medium comprising three or more non-collinear electrodes in electrical contact with the medium and a control system connected to vary voltages applied to said electrodes over time to apply to the medium a first electric field having an alternating component directed in a first direction and a second electric field having an alternating component transverse to the first direction.

The claims must be limited to one inventive concept as set out in *PCT Rule 13*.
4. Consequently, this opinion has been established in respect of the following parts of the international application :
☐ all parts
☒ the parts relating to claim 1-112, 141-167 and 182 (Group A)

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims 1-112, 141-167 and 182	YES
	Claims	NO
Inventive step (IS)	Claims 1-112, 141-167 and 182	YES
	Claims	NO
Industrial applicability (IA)	Claims 1-112, 141-167 and 182	YES
	Claims	NO

2. Citations and explanations :

Reference is made to the following document:

D1: Asbury et al., "Trapping of DNA in Nonuniform Oscillating Electric Fields", Biophysical Journal, Volume 74, February 1998, 1024-1030.

D1 appears to represent the closest prior art and describes a method in which DNA molecules are pulled by a gradient force to regions of high electric field strength due to the induction of an electric dipole. Molecules can then be locally trapped in an oscillating field using strips of very thin gold film to generate strong electric fields with steep gradients. D1 does not describe the simultaneous use of a time-varying driving field and a mobility-varying field to induce particle motion.

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The subject matter of Claims 1-112, 141-167 and 182, involves an inventive step in respect of the prior art as defined in the regulations (*PCT Rule 65(1)(2)*) and thus meets the requirements of *PCT Article 33(3)*.

The subject matter of Claims 1-112, 141-167 and 182 comply with *PCT Article 33(4)* since the claimed invention is considered to be industrially applicable since according to its nature, it can be made or used (in the technological sense) in industry.

Box No. VII **Certain defects in the international application**

The following defects in the form or contents of the international application have been noted :

The description does not comply with *PCT Rule 11.13(m)*. The same features, when denoted by reference signs, shall, throughout the entire application, be denoted by the same signs. On page 50 (paragraph 0150) of the description, reference character "25" is used to represent the "capillary", however previously, reference character "125" was used to represent the "capillary".

The drawings do not comply with *PCT Rule 11.13(l)*. Reference signs not mentioned in the description must not appear in the drawings, and vice versa. Reference signs "21A" and "21B" (page 27, lines 14 and 15, respectively) do not appear in the drawings. Also, reference sign "25" (page 50, line 4) does not appear in the drawings.

All documents referred to in the description of an application should be available to the public. Reference to the documents on page 1, lines 7 and 8 should be deleted or replaced by their corresponding patent or publication numbers (*PCT Article 5*).

Box No. VIII **Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made :

Claims 183 and 184 fail to comply with *PCT Rule 6.4(b)*. Omnibus claims are of indefinite scope thus compromising the overall clarity of the claims.

The dependent claims fail to comply with *PCT Rule 6.4(b)*. Dependent claims shall be construed as including all the limitations contained in the claim(s) to which they refer. In this instance, the inclusion of the subject-matter of Claim 11 into subsequent dependent claims is problematic. For example, Claim 33 refers to Claim 25 which refers to Claim 11 which stipulates that the driving field and the mobility-varying field are "of the same type". However, Claims 25 and 33 define an *acoustic* driving field and a mobility-varying field comprising exposing the particles to *electromagnetic radiation*, respectively. Note that this problem has been identified throughout the set of dependent claims which include a reference to Claim 11.

Claim 67 is indefinite and does not comply with *PCT Article 6*. The expression "the photoactive molecules" (Claim 67, line 1) has no antecedent.